

EVOLVABLE CYROGENICS (ECRYO) PRESSURE TRANSDUCER CALIBRATION TEST

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ABSTRACT

This paper provides a summary of the findings of recent activities conducted by Marshall Space Flight Center's (MSFC) In-Space Propulsion Branch and MSFC's Metrology and Calibration Lab to assess the performance of current "state of the art" pressure transducers for use in long duration storage and transfer of cryogenic propellants. A brief historical narrative in this paper describes the Evolvable Cryogenics program and the relevance of these activities to the program. This paper also provides a review of three separate test activities performed throughout this effort, including: (1) the calibration of several pressure transducer designs in a liquid nitrogen cryogenic environmental chamber, (2) the calibration of a pressure transducer in a liquid helium Dewar, and (3) the calibration of several pressure transducers at temperatures ranging from 20 to 70 degrees Kelvin (K) using a "cryostat" environmental chamber. These three separate test activities allowed for study of the sensors along a temperature range from 4 to 300 K. The combined data shows that both the slope and intercept of the sensor's calibration curve vary as a function of temperature. This homogeneous function is contrary to the linearly decreasing relationship assumed at the start of this investigation. Consequently, the data demonstrates the need for lookup tables to change the slope and intercept used by any data acquisition system. This ultimately would allow for more accurate pressure measurements at the desired temperature range. This paper concludes with a review of a request for information (RFI) survey conducted amongst different suppliers to determine the availability of current "state of the art" flight-qualified pressure transducers. The survey identifies requirements that are most difficult for the suppliers to meet, most notably the capability to validate the sensor's performance at temperatures below 70 K.